



B. MILLER
ENGINEERING

PO Box 483 Deerfield, IL 60015
Phone: (847) 948-7746 Fax: (847) 948-7340
www.bmillerengineering.com

March 29, 2006

Illinois Commerce Commission
527 East Capitol Ave
Springfield, IL. 62701

Attention: John Shab, Consumer Services Division

Subject: Complaint #200601251S
{redacted}

Dear Mr. Shab

I understand from our telephone discussion that ComEd has submitted a response to my complaint. While I do not have a copy of that response, following is my understanding of the key points, based on discussions with you and Mark Lewandowski of ComEd:

1. ComEd measured 8 – 9% THD at the sub-station, and noted similar THD levels on all of the feeders
2. ComEd can not identify any equipment problems causing this harmonic level (they did correct some capacitor bank issues, but there was no effect on the harmonic levels)
3. ComEd can not identify any single contributor of high harmonic current
4. ComEd blames the aggregate of single-phase power supplies in computers and electronic appliances on the distribution system
5. ComEd has no means in place to regulate third harmonic distortion and there is nothing more they can do

Following are my comments:

Item1

This harmonic voltage distortion exists at every customer receiving power from that sub-station, making this a widespread problem. A spot check of several locations (See *Appendix A*) confirms that the problem exists in the southern part of Deerfield, the northern area of Northbrook, and one area to the west in Riverwoods which measured 10% THD. Assuming they are on the same feeder, they would be the furthest from the sub-station. I have not performed a detailed survey to determine the extent of the affected area, as this information is available from ComEd if needed.

Items 2 & 3

I have not seen the details as to what ComEd investigated beyond the sub-station measurements, so I cannot comment further on these.

Item 4

ComEd only presents a partial picture. Harmonic current is one of the factors causing voltage distortion. The supply system is another. Distortion occurs due to harmonic voltage drop across the supply impedance at the harmonic frequency. An ideal supply with zero impedance would produce no harmonic voltage distortion, regardless of the current. Higher supply impedance, as would occur for example with under-sized equipment and lines, will produce higher voltage distortion.

Item 5

Appendix B shows the measured power quality in several other areas. All of the voltage THD levels are below 5%, with several much lower. In fact, one school in Deerfield has very low distortion, while surrounded by residences with high levels. It is impossible to accept that the customers on those distribution systems do not have computers and electronic appliances.

Appendix C shows the Deerfield harmonic distortion over a typical 24-hour period. While there is a small variation from day to night, the distortion is still above 7% in the middle of the night, when there are far fewer offending loads on the system, and up to 9% during the day. There is also a lack of randomness, with no measurements ever dropping below 7%. In addition, spikes of 16-17% THD occurred for short periods of time, which I cannot yet explain.

All of this is inconsistent with ComEd's theory that the distortion is the normal result of customer non-linear loads. Rather, it suggests a system problem that ComEd has not yet identified.

Other comments

- Mark Lewandowski mentioned that only one other person, another electrical engineer, has complained about this problem. This is not surprising. The typical electrical customer is not aware of harmonics, cannot measure them, and therefore cannot complain about them, even if they are experiencing related problems. This point is undoubtedly not lost on ComEd.
- Industry documents and standards, a few of which I submitted with my initial complaint, point to the existing harmonic levels as being excessive and causing problems. A quote from the Electrical Power Research Institute (EPRI) in one of those articles states (emphasis added):

"On a small percentage of distribution systems you will find distortion above 5%. We usually start to see problems when the voltage THD gets above about 7%. At that point, capacitor bank fuses begin to blow, uninterruptible power supplies begin to operate when they shouldn't, power factor correction equipment fails and motors overheat. **At 7%, someone has to do something. Either the utility makes the customers that are causing the distortion install filters or the utility adds filters to the distribution system,**"

- There are costs to consumers. The extra heat caused by voltage harmonics in motors, small transformers, and other magnetic devices represents wasted energy that consumers pay for. It also reduces the life of those devices. Likewise, light bulbs produce more power, resulting in additional energy costs and shorter bulb life,
- There are safety issues. In facilities with four-wire three-phase systems, this high level of third harmonic voltage can cause excessive neutral currents which poses a very real and well-known potential fire hazard due to overheated neutral wiring. This could apply to a number of office buildings and other commercial establishments in the affected area.
- ComEd demonstrates the ability to deliver acceptable levels of voltage distortion in nearby areas, which certainly have similar customer loads. Deerfield should receive the same quality power.

Thank you for your continued attention to this matter.

Sincerely,

A handwritten signature in black ink, appearing to read "Ben Miller". The signature is written in a cursive, flowing style with a small accent mark above the 'i' in "Miller".

Benjamin D. Miller, P.E.

Tel: 847-948-7746

e-mail: ben@bmillerengineering.com

APPENDIX A

Deerfield area distortion measurements Jan – Mar, 2006

<u>Location</u>	<u>Type of facility</u>	<u>THD</u>
Riverwoods - Thorngate	Residence	10.0%
Deerfield - Laurel & Pine	Residence	9.5%
Deerfield – Birchwood & Sprucewood	Residence	8.2%
Northbrook	Residence	7.9%
Deerfield	South Park School *	1.8%

* The source of power at the school apparently differs from the surrounding neighborhood

APPENDIX B

Distortion measurements Jan – Mar, 2006

<u>Location</u>	<u>Type of facility</u>	<u>THD</u>
Highland Park, IL	Residence	4.6%
Arlington Heights, IL	Industrial facility *	4.1%
Skokie, IL	Oakton College	1.8%
Des Plaines, IL	Residence	1.7%
Northbrook, IL	Underwriters Labs office	1.5%
Bellwood, IL	Industrial office	0.6%

* Measured prior to 2006

APPENDIX C

24-hour THD & voltage starting 10:13 pm on 2/16/2006.

